THE EFFECT OF GRASS CONTROL MEASURES IN PASTURE ON WEED POPULATIONS AND GRAIN YIELD IN FOLLOWING WHEAT CROPS

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Summary. Control of annual grasses or their seed production in pasture with herbicides can reduce grass weed levels in wheat following pasture. The effect of these treatments in either the last 1 or 2 years of pasture on weed populations and crop yield in following wheat was examined in the experiment reported. Ryegrass, *Lolium rigidum*, was reduced up to 75% and silver-grass, *Vulpia bromoides*, from 63 to 93% in the first wheat crop by treatments used in pasture. Wheat yield was increased by an average 0.84 t/ha over 2 wheat crops. Chlorsulfuron further reduced weed levels and gave an additional 1.15 t/ha yield increase.

INTRODUCTION

When wheat is grown in rotation with pasture, annual grasses can often occur as weeds in the wheat crops. These grasses reduce crop yield if not controlled, place extra demand on selective herbicides and can carry cereal root diseases into the wheat crops. In addition, some species, such as the silver-grasses, *Vulpia* spp. are not readily controlled by selective herbicides. Herbicides can be used to control grasses or reduce grass seed set (chemical topping) during pasture, resulting in lower populations in following wheat crops (1, 6, 7, 12, 17). Grass control can also increase clover vigour in pastures resulting in increased fixation of nitrogen for use by following crops.

In the experiment reported in this paper grass control and chemical topping treatments were applied in pasture for the last 1 or 2 years before wheat crops. The effects of these treatments on weed populations in wheat, the incidence of disease and grain yield of wheat are reported in this paper.

In a total wheat/sheep farming system the effects of such pasture treatments would need to be considered on both the cropping and sheep enterprises. This paper considers only the effects on the wheat enterprise.

METHODS

The experiment was conducted at Rutherglen Research Institute from 1984 to 1987. The site, on a grey/brown loam soil (13) was pasture in 1984 and 1985 and wheat in 1986 and 1987. Subterranean clover, *Trifolium subterraneum*, cv. Seaton Park was sown on 1 June 1984. A mixed pasture of annual ryegrass, silver-grass and clover germinated.

Herbicides were used to either kill grasses in pasture (carbetamide 2.1 kg/ha) or to reduce grass seed set (Paraquat 0.1 kg/ha) and were applied in both pasture years or in 1985 only. Carbetamide was applied on 28 August 1984 and 7 June 1985. Paraquat was applied early November.

Pasture was grazed periodically to reduce pasture height.

In 1986 and 1987 selected plots were scarified and harrowed several times to produce a fine seedbed. Remaining plots were direct drilled after application of glyphosate 0.54 kg/ha plus dicamba 0.14 kg/ha. Matong wheat was sown with a narrow point drill on 9 May 1986 and 6 May 1987.

Chlorsulfuron 18.75 g/ha was applied 5 to 6 weeks after sowing, to sub plots (Table 2).

Main plots (pasture treatments) were 13x4 m, sub plots were 13x2 m. Treatments were in randomised blocks by 4 replicates.

Plant species were counted in all years in 5 0.06 m^2 quadrats/plot after herbicide treatments were applied each year (except chemical topping) and also before treatments were applied in 1985 pasture. Unfilled wheat heads were counted in 3 m of crop row/plot. Wheat grain yield was measured by harvesting whole plots.

RESULTS AND DISCUSSION

Plant populations in pasture are shown in Table 1. Figures from October 1984 and November 1985 were obtained after carbetamide application and the May 1985 figures show pre-carbetamide populations for 1985.

Carbetamide very effectively controlled silver-grass in both years. The control obtained in 1984 also reduced levels in the 1985 pasture from 7145/m^2 (unsprayed) to 277/m^2 before re-spraying. Ryegrass was also reduced by carbetamide but not as marked as with silver-grass. The 108 plants/m^2 counted at 18 November 1985 seeded well. Spray-topping in 1984 effectively reduced grasses as seen by the 15 May 1985 count.

The large reduction in plant numbers between May and November 1985 would be due mainly to death of weaker seedlings through plant competition.

Table 1.The effect of herbicide treatments on pasture composition.

	Plants/m^{-2}							
	31.10.84			15.5.85			18.11.85	
	SG	RG	SC	SG	RG	SC	SG	RG
Pasture unsprayed	1809	470	63	7145	810	184	200	380
Carbetamide 1984 & 1985	1	43	67	277	830	623	0	4
Carbetamide 1985 only	-	-	-	-	-	-	0	108
Spray top 1984 & 1985	-	-	-	2155	340	345	-	-
l.s.d. (P=0.05)	306	62	NSD	2484	NSD	137	-	-

SG = Silver-grass, RG = ryegrass, SC = subterranean clover

Populations in wheat crops of ryegrass, silver-grass and subterranean clover are shown in Table 2. Some other weed species also occurred but at low levels.

The herbicide treatments applied to reduce grasses or grass seed set in pasture significantly reduced silver-grass in the first wheat crop. In direct drilled wheat percent reductions ranged from 63% after spray topping in 2 years, to 93% after 2 years of carbetamide. There was no significance (P=0.05) between the herbicide treatments.

Table 2. Weed populations in wheat and grain yield in 1986 and 1987 after pasture treatment in 1984 and 1985.

Treatments		Weed populations/m^{-2}						Wheat Yield (t/ha)	
Pasture (1984 & 1985)	Wheat (1986 & 1987)	24.9.86 RG	SG	SC	10.11.87 RG	SG	SC	1986	1987
No grass control.	DD, unsprayed	294	113	77	86	51	2	2.30	2.22
"	DD, sprayed	134	116	7	46	36	0	4.10	3.36
Carbetamide appln. 1984 & 1985	DD, unsprayed	142	7	140	139	4	13	3.85	1.89
"	DD, sprayed	61	12	13	26	3	0	5.67	3.19
Carbetamide appln. 1985	DD, unsprayed	299	17	126	114	5	16	3.31	2.06
"	DD, sprayed	101	6	2	36	7	0	5.34	3.38
Grasses spray-topped 1984 & 1985	DD, unsprayed	75	42	85	70	68	7	4.43	1.90
"	DD, sprayed	26	6	19	15	10	0	5.06	2.85
Grasses spray-topped 1985	DD, unsprayed	127	28	59	77	70	14	3.83	1.73
"	DD, sprayed	27	4	26	35	22	0	4.89	2.82
No grass control	CC, unsprayed	283	59	61	199	26	11	2.55	1.69
"	CC, sprayed	174	29	9	75	7	0	4.89	2.94
Grasses spray-topped 1984 & 1985	CC, unsprayed	62	19	85	95	18	12	5.15	2.04
"	CC, sprayed	11	2	5	18	12	0	5.75	2.87
l.s.d. (P=0.05)		65	45	52	60	28	10	0.74	0.61

DD = direct drilled, CC = conventional cultivation

Ryegrass in 1986 was significantly reduced by 3 of the 4 pasture treatments (57 to 74%) prior to direct drilling of wheat. It was not reduced by carbetamide applied in 1985 only. This treatment reduced ryegrass by 71% in the 1985 pasture but remaining plants seeded well, probably accounting for the nil reduction in the 1986 wheat crop. Spray-topping over 2 years was the most effective treatment for reducing ryegrass (74% reduction).

Subterranean clover populations in the 1986 wheat were significantly higher with both the 1 or 2 year carbetamide treatments (due to reduction of grass competition resulting in increased clover vigour and seed set in pasture years). Spray-topping did not significantly increase clover population in wheat.

Chlorsulfuron reduced ryegrass population by an average of 63% in the 1986 wheat crop in both direct drilled and cultivated seedbeds. Silver-grass populations were lower in the chlorsulfuron sub-plots for 5 of the 7 main plot treatments (pasture treatment) but differences were not significant in the analyses conducted due to low and variable populations. Chlorsulfuron has demonstrated some control of silver-grass in previous experiments (1).

Suberranean clover was well controlled by chlorsulfuron, with reduction generally being above 90%.

Weed populations in 1987 were lower than in 1986, possibly due to less rainfall at the start of the 1987 season.

Reduction in weed populations due to pasture treatment were less obvious and more variable in 1987. The reason for the high ryegrass population after 2 years of carbetamide and high silver-grass after both chemical topping treatments is not obvious. Chlorsulfuron again provided effective in-crop control, in 1987.

Cultivation resulted in a silver-grass population significantly lower in 1986 than with direct drilling, after unsprayed pasture. The occurrence of higher levels of silver-grass with direct drilling has been reported previously (1, 2).

Wheat yields (Table 2) were significantly increased in 1986 by prior treatment of grasses in pasture. Increases ranged from 1.01 t/ha after carbetamide for 1 year to 2.13 t/ha after 2 years of chemical topping. An average increase of 1.68 t/ha was obtained. The lower increase was probably due to the level of ryegrass present in this treatment in 1986.

Significant yield differences due to the 1984-85 pasture treatment did not occur in the 1987 cropping season.

Chlorsulfuron, when used for in-crop weed control, gave significant yield increases across all treatments with an average of 1.47 t/ha in 1986 and 1.13 t/ha in 1987 above the average increase obtained by pasture treatment.

Although pasture treatments or use of chlorsulfuron both reduced weed levels and increased wheat yields, these treatments combined provided increased levels of weed control and crop yield.

If wheat yields are totalled for both years for treatments with prior pasture herbicides and with use of chlorsulfuron in wheat, grass control (carbetamide) over 2 seasons gives the highest yield (8.86 t/ha), pasture topping for 1 season is lowest (7.71 t/ha), others are between.

The number of unfilled wheat heads counted in treatments ranged from 0.3 to 6.9/m of row in 1986 and nil to 1.7/m of row in 1987. Sterile spikes were most probably caused by the take-all fungus, *Gaeumannomyces gramminus* var tritici. These levels are regarded as relatively low (Bellinger pers. comm.). Levels in 1986 were higher on chlorsulfuron sprayed plots (average of 4/m row) than without (1/m row).

Data from this experiment shows the value of pasture treatments to control grasses in wheat production systems, however the effects on the livestock enterprise need more consideration and further work is needed to examine effects on total farm income. Although grass control in pastures can provide obvious benefits to cropping, this may not be so to the grazing enterprise (3, 8, 11, 16).

Carbetamide is an expensive herbicide, but was used in this experiment because of its effectiveness on silver-grass and ryegrass, and its safety on clover. Other treatments such as simazine plus fluazifop (butyl ester) may be just as effective at a lower cost (Leys pers. comm, Code unpublished data).

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